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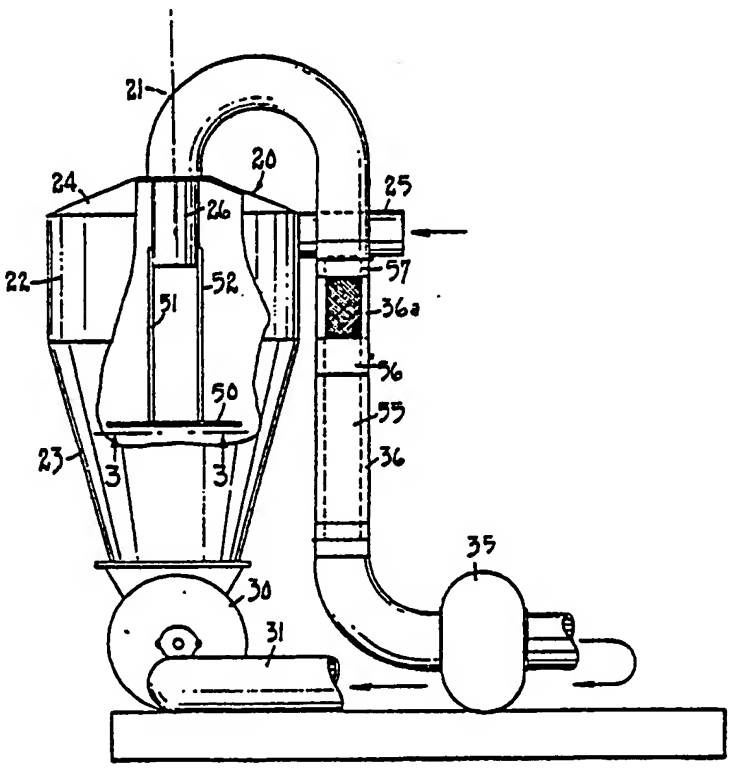
(54) Title: GRAIN HANDLING APPARATUS WITH IMPROVED CYCLONE SEPARATOR

(57) Abstract

A positive displacement blower (35) creates a vacuum within separator housing (20). Bulk material such as grain drawn in through the tangential inlet (25) is centrifugally separated and transferred into a discharge conduit (31) by a rotary airlock conveying valve (30) from where it is picked up and discharged by a flow of high pressure air from the blower (35). A baffle (50) is mounted in the separator housing (20) between the conveying valve (30) and the axial air outlet (26) to block air which leaks through the conveying valve (30) and material carried thereby from directly entering the center of the vortex in the area of the air outlet conduit (26).



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GRAIN HANDLING APPARATUS WITH IMPROVED CYCLONE SEPARATOR

Technical Field

This invention relates generally to apparatus for pneumatically moving or conveying bulk material. More specifically, a baffle is provided in the cyclone separator of a grain conveyor which utilizes a positive displacement blower, and in which separated grain is removed from the separator by a rotary airlock conveying valve, to block particles blown upwardly by air leaking through the airlock from entering the center of the cyclone, thus dramatically improving separating performance and reducing blower damage and wear.

Summary of the Invention

Prior art pneumatic grain conveyors have utilized cyclone separators to permit the grain to completely bypass the fan or blower. The suction created by the fan draws both air and grain carried thereby into the separator. The grain which is centrifugally separated is removed from the separator through an airlock system where the air being discharged from the fan conveys the grain to a discharge point. Positive displacement blowers, as opposed to fans, have been used to obtain larger capacity with lower horsepower requirements. In addition, blowers are smaller, resulting in a more compact unit which is easier to handle, and less grain damage is caused because a system employing a blower can use smaller lines. A negative factor is that blowers can be damaged if larger particles are not separated from the air stream. Dust which is picked up also causes wear to the rotors. To overcome this problem, prior art pneumatic grain movers with blowers have used large filters in the cyclone separator to remove dust and grain not previously separated.

Such filters are not only cumbersome and require periodic cleaning, but also increase the pressure drop and reduce airflow through the system. However, such filters have been necessary in order to prevent damage to the rotors of positive displacement blowers, which rotate within a cylinder with very small internal clearances.

It is applicant's discovery that such cumbersome filter arrangements can be eliminated by utilizing a baffle mounted within the separator to block a substantial area between the grain discharge outlet at the bottom of the separator and the air outlet located at the center of the cyclone. Because there is a substantial pressure difference existing across the airlock, there is some leakage of air into the separator which carries grain and foreign material with it upwardly into the separator where the clean air is being removed at the center of the vortex. In the prior art systems, a certain amount of this foreign material was re-entrained in the air stream and carried into the fan. Although it is preferable to use a small safety filter with the present invention, the baffle has eliminated the need for elaborate filter arrangements, thereby dramatically increasing the cyclone separator's performance, which both increases the efficiency of the system and reduces the likelihood of damage to the blower. The present invention has its greatest utility when used in a system employing a positive displacement blower, but it can also be used with prior art systems employing fans to substantially reduce the amount of material being carried through the fan.

Brief Description of the Drawings

FIGURE 1 is a schematic representation of a conventional prior art pneumatic grain-handling system.

FIGURE 2 is a similar view in side elevation of the pneumatic grain-handling system of the present invention, portions thereof being broken away.

FIGURE 3 is a sectional view taken along line 3-3 of FIGURE 2.

FIGURE 4 is a schematic view in cross-section of a rotary airlock conveying valve of the type used in the present invention.

FIGURE 5 is a schematic cross-sectional view of a positive displacement pump or blower of the type used in the present invention.

Description of the Preferred Embodiment

FIGURE 1 depicts a prior art grain-moving system employing a fan. The fan 10 rotates at a high speed to draw air from the centrifugal separator 11 through the conduit 12 to in turn draw air through the conduit and flexible hose 13. Grain is drawn by the moving air into the conduit 13 and enters the separator 11 through a tangential inlet which creates a vortex within the separator. The resulting centrifugal force applied to the grain causes it to move to the outside of the separator housing and swirl downwardly by gravity to a rotary airlock conveying valve 14. The incoming air continually moves to the center of the vortex and is pulled out through conduit 12 by the fan, which discharges the air through the discharge conduit 15. The conveying valve 14 transfers the grain from the separator 11 into the discharge conduit 15 where it is picked up by the air from the fan and carried to the discharge hopper 16. This system permits the grain to be easily transferred or moved by air, but the grain bypasses the fan so that it is not damaged in the process. The prior art grain mover shown in FIGURE 1 is a portable unit and the fan and rotary conveying valve would typically be driven from the power take-off of a tractor. The system shown in FIGURE 1 does not need a filter because the cyclone separator removes substantially all of the grain and foreign material from the air stream, but to the extent that some material does pass through the fan, the fan is not damaged thereby.

FIGURE 2 discloses in somewhat schematic form a preferred embodiment of the present invention. The cyclone separator 20 includes an elongated housing formed

about a vertical, longitudinal axis 21, the housing having walls forming a generally cylindrical upper portion 22, a truncated conical lower portion 23 and a top end wall 24. Upper portion 22 has a tangential inlet 25 in the wall thereof, and top end wall 24 has an axial outlet conduit 26, the bottom end of which terminates near the center of the upper portion 22.

The bottom end of lower portion 23 is provided with a separated material outlet opening which connects to a rotary airlock conveying valve 30. The conveying valve 30 is designed to transfer separated material from separator 20 into a discharge conduit 31 while at the same time maintaining the pressure difference between the interior of the separator 20 and the discharge conduit 31.

A positive displacement pump or blower 35 has its intake connected by a suitable conduit 36 to the axial air outlet 26. Blower 35 discharges into discharge conduit 31 creating a high-pressure air flow therethrough to pick up the grain transferred into it by the conveying valve 30 for distribution to a remote location through a continuation of the discharge conduit which is not shown.

FIGURE 4 depicts in schematic form a cross-section of a typical conveying valve 30. The conveying valve 30 has a rotor 32 with a plurality of spaced, flat blades 32a which form a plurality of spaced pockets 33. The edges of the blades 32a engage the inner wall of the housing of the valve 30 to prevent the pressurized air in the discharge conduit 31 from flowing back through the valve into the separator housing 20. It can be seen that as the rotor 32 is rotated, grain from the lower portion 23 of the housing is picked up by the pockets 33 and transferred to the base of the unit which is connected with suitable adaptors on each end to the air discharge line 31. The high-pressure air flowing through the discharge conduit 31 thus empties the pockets 33 as they reach the base of the unit. Although not shown on the drawings, the rotor 32 is driven either by an electric

motor mounted on the unit or from the power take-off of a tractor through a suitable chain drive or transmission.

FIGURE 5 discloses schematically the principle of operation of the pump or blower 35. The blower is of the positive displacement type and has two figure-eight rotors 37 and 38, mounted as shown, which rotate in opposite directions to carry air from the inlet 39 to the outlet 40. Each of the rotors 37 and 38 rotate within a cylindrical portion of the housing and very small clearances are provided between the two rotors and between the two rotors and the housing. The air discharged from the outlet 40 will be at relatively high pressure, which extends throughout the discharge system. Blowers or pumps of this nature are preferable to fans because greater air flow can be achieved with less horsepower. However, because of the critical tolerances within the blower, the blower must be protected from foreign material. Grain or pieces of other bulk material being handled can cause damage to the blower and even dust particles will cause wear to the rotors and to the walls of the blower housing.

To prevent such material from entering the blower 35, a baffle 50 has been mounted within lower portion 23 to block a substantial area between the material outlet and the air outlet conduit 26. In the preferred embodiment, baffle 50 is a circular plate which is rigidly mounted to the bottom end of the outlet conduit 26 by a plurality of support rods 51, 52. Baffle 50 is preferably circular and is centered on axis 21, perpendicular thereto. The edge of baffle 50 is spaced from the wall of lower portion 23 to permit separated material to pass therebetween. Thus, a generally ring-shaped opening, free of obstruction, is provided between the baffle 50 and lower portion 23 through which the separated grain can swirl downwardly toward the airlock 30.

Although baffle 50 has been found to be highly effective in preventing extraneous material from entering the air outlet 26, a safety or emergency filter 55 is

mounted within the conduit 36. Conduit 36 includes as a portion thereof a plexiglas tube 36a which is connected into the line by means of clamps 56 and 57 to permit visual inspection of the filter 55. Filter 55 is a cylindrical screen or mesh structure mounted coaxially within conduit 36, having a closed upper end and an open bottom end. A baffle (not shown) is provided at the bottom end of the filter 55 between it and the conduit 36 so that air is forced to pass through the walls of filter 55 and be discharged axially therefrom. Filter 55 is constructed of a relatively heavy-mesh screen so that it offers little resistance to air flow. It is strictly a safety or emergency filter because in the present invention, virtually no particles are left in the air stream drawn from separator 20.

Operation

Blower 35 creates suction in conduit 36 to draw air from separator housing 20 through axial outlet 26. The vacuum thus created draws air into the housing through tangential inlet 25, creating a vortex about the axis 21. Bulk material being carried into the housing through tangential inlet 25 is caused to swirl about the interior of the housing and gradually moves downwardly in a swirling pattern toward the bottom of lower portion 23. The vortex has a relatively clear center from which air is drawn into outlet 26. The separated material is carried by conveying valve 30 into discharge conduit 31 which carries a flow of high pressure air from the outlet of blower 35. It should be noted that a substantial pressure difference exists between the interior of housing 20 and the interior of discharge conduit 31. As a result, there is a strong tendency for high pressure air within discharge conduit 31 to force its way through the conveying valve into the vacuum existing within the separator 20. Referring to FIGURE 4, one serious aspect of the leakage

problem is that the pockets 33 fill with high pressure air as they line up with conduit 31, and further rotation of the rotor 32 carries these pockets of high pressure air upwardly for discharge into separator 20. The result is that each time a pocket 33 returns to near its top position, a puff of high pressure air is released into separator housing 20. These repeated bursts of high pressure air expand upwardly into the housing toward the center of the vortex and carry with them some of the bulk material, foreign particles, and dust. Because these materials are thrown upwardly into the center of the vortex, some of them escape separation, and unless precautions are taken, are drawn into the blower or fan. It is the discovery of the present invention that this problem can be overcome by mounting within the housing 20, in the path of the air leaking into the housing, a baffle 50 to block the leakage air and the material carried thereby from directly entering the center of the vortex near the air outlet means 26. Baffle 50 effectively deflects upwardly thrown material and forces it outwardly into the swirling stream of material which surrounds the baffle. The larger particles and dust are thus re-entrained in the stream of material, while the leakage air is permitted to flow around the baffle into the center of the vortex to be withdrawn from the housing with the other air. The vertical positioning of the baffle is not critical although in the preferred form of the invention it is shown to be located near a vertical midpoint of the lower portion 23. Further, the shape of the baffle is not critical and other shapes or configurations could be used so long as they perform the function of blocking foreign material from being discharged directly into the center of the vortex. The baffle could also have a conical top or conical bottom portion without departing from the invention.

Vented air locks are available which release the pressure to atmosphere rather than transferring it into the housing, but they reduce the area at the inlet avail-

able for filling the rotor and they are more expensive. Further, even if a vented air lock is used, there is still some leakage around the rotor because of the high pressure drop across the conveying valve. With the present invention, there is no need to use the more expensive vented air locks.

Although the present invention has its greatest utility in a system employing positive displacement blowers or pumps, it can also be used in prior art fan type systems to reduce the amount of material passing through the fan. The system employing the present invention can be utilized to move any bulk flowable material including such examples as grain, plastic pellets and fertilizer.

WHAT IS CLAIMED IS:

1. Pneumatic apparatus for conveying bulk material, comprising:

a cyclone separator comprising a housing formed about a longitudinal axis, said housing having walls forming a generally cylindrical upper portion with a tangential inlet and a top end wall, and a truncated conical lower portion with a separated material outlet at a bottom end thereof;

an air outlet conduit in said top end wall;

a material discharge conduit adjacent said material outlet;

means including a rotary airlock conveying valve mounted in said material outlet for transferring separated material from said housing to said discharge conduit;

means including blower means and conduit means for drawing a flow of air through said air outlet conduit to thereby lower the pressure within said housing and generate a flow of air through said tangential inlet and said cyclone separator to form a vortex in said housing to separate material carried into said housing through said tangential inlet with said air, and for discharging air taken by said air outlet conduit from the center of said vortex through said discharge conduit to carry therewith the separated material in the discharge conduit; and

a baffle mounted within said lower portion to block a substantial area between said material outlet and said air outlet conduit;

whereby higher pressure air entering said housing through said rotary airlock conveying valve, and material carried upwardly thereby, are blocked by said baffle and prevented from

directly entering the center of said vortex in the area of the air outlet conduit.

2. The apparatus of claim 1 wherein said blower means is a positive displacement blower which draws air from said air outlet conduit and discharges said air into said material discharge conduit, whereby the high pressure air in said discharge conduit which is periodically released into said housing by said rotary airlock conveying valve blows upwardly into said housing carrying with it portions of said material and foreign matter carried thereby.

3. The apparatus of claim 2 wherein said baffle is circular and is centered on said axis perpendicular thereto.

4. The apparatus of claim 1 wherein said baffle is positioned centrally within said housing and is spaced from said wall of said housing to permit separated material to pass therebetween.

5. The apparatus of claim 4 wherein said baffle is circular and is centered on said axis perpendicular thereto.

6. The apparatus of claim 1 wherein said air outlet conduit extends axially into said housing and terminates within the center of said upper portion and wherein said baffle is spaced centrally within said lower portion so that a generally ring-shaped opening is provided between said baffle and said lower wall portion through which the separated material passes.

7. The apparatus of claim 1 wherein said blower means is a positive displacement blower which draws air from said air outlet conduit and discharges said air into

said material discharge conduit, and wherein a safety filter is mounted in said conduit means leading to said blower.

8. Pneumatic grain moving apparatus, comprising:

a cyclone separator comprising a housing formed about a longitudinal axis with a grain discharge outlet at a bottom end thereof;

an air inlet and an air outlet in said housing;

a grain discharge conduit adjacent said grain discharge outlet;

means including airlock means mounted in said grain discharge outlet for transferring grain from said housing to said discharge conduit;

means including a positive displacement blower and conduit means for drawing a flow of air through said air outlet to thereby lower the pressure within said housing and generate a flow of air through said air inlet and said cyclone separator to form a vortex in said housing to separate grain carried into said housing through said air inlet with said air, and for discharging air taken by said air outlet from the center of said vortex through said discharge conduit to carry therewith the grain in the discharge conduit;

a safety filter mounted in said conduit means between said air outlet and said blower; and

a baffle mounted within said lower portion to block a substantial area between said grain discharge outlet and said air outlet;

whereby higher pressure air leaking into said housing through said airlock means, and grain and foreign material carried upwardly

thereby, are blocked by said baffle and prevented from directly entering the center of said vortex in the area of the air outlet.

9. The apparatus of claim 8 wherein said baffle is positioned centrally within said housing and is spaced from said housing to permit grain to pass therebetween.

10. The apparatus of claim 9 wherein said baffle is circular and is centered on said axis perpendicular thereto.

11. The apparatus of claim 8 wherein said air outlet includes a conduit extending axially into said housing from a top end thereof and wherein said baffle is circular and spaced centrally within said housing so that a generally ring-shaped opening is provided between said baffle and said housing.

12. The apparatus of claim 11 wherein said baffle is rigidly suspended from said air outlet conduit so that said ring-shaped opening is free of obstruction.

13. Bulk material conveying apparatus, comprising:

(a) a separator housing;

(b) means, including air inlet and air outlet means in said housing, for generating a flow of air through said housing to centrifugally separate material carried into said housing with said air;

(c) means including a discharge outlet in said housing for transferring separated material from said housing while substantially blocking air flow into said housing through said discharge outlet; and

(d) baffle means mounted within said housing between said discharge outlet and said air

outlet means to prevent air leaking into said housing through said discharge outlet from directly entering said air outlet means.

14. The apparatus of claim 13 wherein said housing has a generally cylindrical upper portion with a tangential inlet, a top end wall, and a truncated conical lower portion with said discharge outlet at a bottom end thereof, and wherein said baffle means is mounted within said lower wall portion.

15. The apparatus of claim 14 wherein said air outlet means comprises conduit means extending through said top end wall into the center of a vortex created in said housing by said flow of air, and wherein said baffle means is positioned to prevent the leakage air and the material carried thereby from directly entering the center of said vortex in the area of the air outlet conduit.

16. The apparatus of claim 15 wherein said housing is formed about a longitudinal axis, wherein said baffle is circular and is centered on said axis perpendicular thereto.

17. The apparatus of claim 13 wherein said means for generating a flow of air through said housing comprises a positive displacement blower which draws air from said air outlet means, and wherein said separator housing, including air inlet and air outlet means, is configured as a cyclone separator so that the flow of air therethrough creates a vortex in said housing to separate material carried into said housing with said air.

18. The apparatus of claim 17 wherein said air outlet means includes a conduit extending into the center of said vortex and wherein said baffle means comprises a

plate-like baffle mounted so as to block said leakage air and material carried thereby from directly entering the center of said vortex in the area of the air outlet conduit.

19. The apparatus of claim 18 wherein said baffle is circular and is centered on a longitudinal axis of said housing perpendicular thereto.

20. The apparatus of claim 19 wherein said circular baffle is rigidly mounted on said air outlet conduit so as to provide an open ring-shaped space between said baffle and said housing through which said bulk material can flow.

21. The apparatus of claim 13 wherein said means for generating a flow of air comprises a positive displacement blower, and wherein a safety filter is mounted in conduit means connecting said air outlet means to an intake of said blower.

22. Centrifugal separator apparatus, comprising:

(a) an elongated housing having air inlet and air outlet means;

(b) means for drawing a flow of air through said air inlet means to lower the pressure in said housing and generate a flow of air through said housing, said housing and said air inlet and outlet means being configured and associated so as to form a vortex of flowing air therein to centrifugally separate material being carried into said housing with said air, said air outlet means being positioned to draw air from the center of said vortex;

(c) means including a discharge outlet in said housing below said vortex for transferring

separated material from within said housing to the outside thereof while substantially maintaining said lower pressure in said housing; and

(d) means mounted within said housing in the path of air leaking into the housing through said discharge outlet to block said leakage air and material carried thereby from directly entering the center of said vortex near the air outlet means, to thereby prevent said material from being drawn into said air outlet means.

23. The apparatus of claim 22 wherein said means for drawing a flow of air comprises a blower having an inlet port connected by conduit means to said air outlet means, and wherein said last named means is a baffle.

AMENDED CLAIMS

(received by the International Bureau on 3 November 1981 (03.11.81))

1. Pneumatic apparatus for conveying bulk material, comprising:

a cyclone separator comprising a housing formed about a longitudinal axis, said housing having walls forming a generally cylindrical upper portion with a tangential inlet and a top end wall, and a truncated conical lower portion with a separated material outlet at a bottom end thereof;

an air outlet conduit in said top end wall;

a material discharge conduit adjacent said material outlet;

means including a rotary airlock conveying valve mounted in said material outlet for transferring separated material from said housing to said discharge conduit;

means including blower means and conduit means for drawing a flow of air through said air outlet conduit to thereby lower the pressure within said housing and generate a flow of air through said tangential inlet and said cyclone separator to form a vortex in said housing to separate material carried into said housing through said tangential inlet with said air, and for discharging air taken by said air outlet conduit from the center of said vortex through said discharge conduit to carry therewith the separated material in the discharge conduit; and

a baffle mounted within said lower portion to block a substantial area between said material outlet and said air outlet conduit;

whereby higher pressure air entering said housing through said rotary airlock conveying valve, and material carried upwardly thereby, are blocked by said baffle and prevented from

directly entering the center of said vortex in the area of the air outlet conduit.

2. The apparatus of claim 1 wherein said blower means is a positive displacement blower which draws air from said air outlet conduit and discharges said air into said material discharge conduit, whereby the high pressure air in said discharge conduit which is periodically released into said housing by said rotary airlock conveying valve blows upwardly into said housing carrying with it portions of said material and foreign matter carried thereby.

3. The apparatus of claim 2 wherein said baffle is circular and is centered on said axis perpendicular thereto.

4. The apparatus of claim 1 wherein said baffle is positioned centrally within said housing and is spaced from said wall of said housing to permit separated material to pass therebetween.

5. The apparatus of claim 4 wherein said baffle is circular and is centered on said axis perpendicular thereto.

6. The apparatus of claim 1 wherein said air outlet conduit extends axially into said housing and terminates within the center of said upper portion and wherein said baffle is spaced centrally within said lower portion so that a generally ring-shaped opening is provided between said baffle and said lower wall portion through which the separated material passes.

7. The apparatus of claim 1 wherein said blower means is a positive displacement blower which draws air from said air outlet conduit and discharges said air into

said material discharge conduit, and wherein a safety filter is mounted in said conduit means leading to said blower.

8. Pneumatic grain moving apparatus, comprising:

a cyclone separator comprising a housing formed about a longitudinal axis with a grain discharge outlet at a bottom end thereof;

an air inlet and an air outlet in said housing;

a grain discharge conduit adjacent said grain discharge outlet;

means including airlock means mounted in said grain discharge outlet for transferring grain from said housing to said discharge conduit;

means including a positive displacement blower and conduit means for drawing a flow of air through said air outlet to thereby lower the pressure within said housing and generate a flow of air through said air inlet and said cyclone separator to form a vortex in said housing to separate grain carried into said housing through said air inlet with said air, and for discharging air taken by said air outlet from the center of said vortex through said discharge conduit to carry therewith the grain in the discharge conduit;

a safety filter mounted in said conduit means between said air outlet and said blower; and

a baffle mounted within said lower portion to block a substantial area between said grain discharge outlet and said air outlet;

whereby higher pressure air leaking into said housing through said airlock means, and grain and foreign material carried upwardly

thereby, are blocked by said baffle and prevented from directly entering the center of said vortex in the area of the air outlet.

9. The apparatus of claim 8 wherein said baffle is positioned centrally within said housing and is spaced from said housing to permit grain to pass therethrough.

10. The apparatus of claim 9 wherein said baffle is circular and is centered on said axis perpendicular thereto.

11. The apparatus of claim 8 wherein said air outlet includes a conduit extending axially into said housing from a top end thereof and wherein said baffle is circular and spaced centrally within said housing so that a generally ring-shaped opening is provided between said baffle and said housing.

12. The apparatus of claim 11 wherein said baffle is rigidly suspended from said air outlet conduit so that said ring-shaped opening is free of obstruction.

13 to 23 cancelled

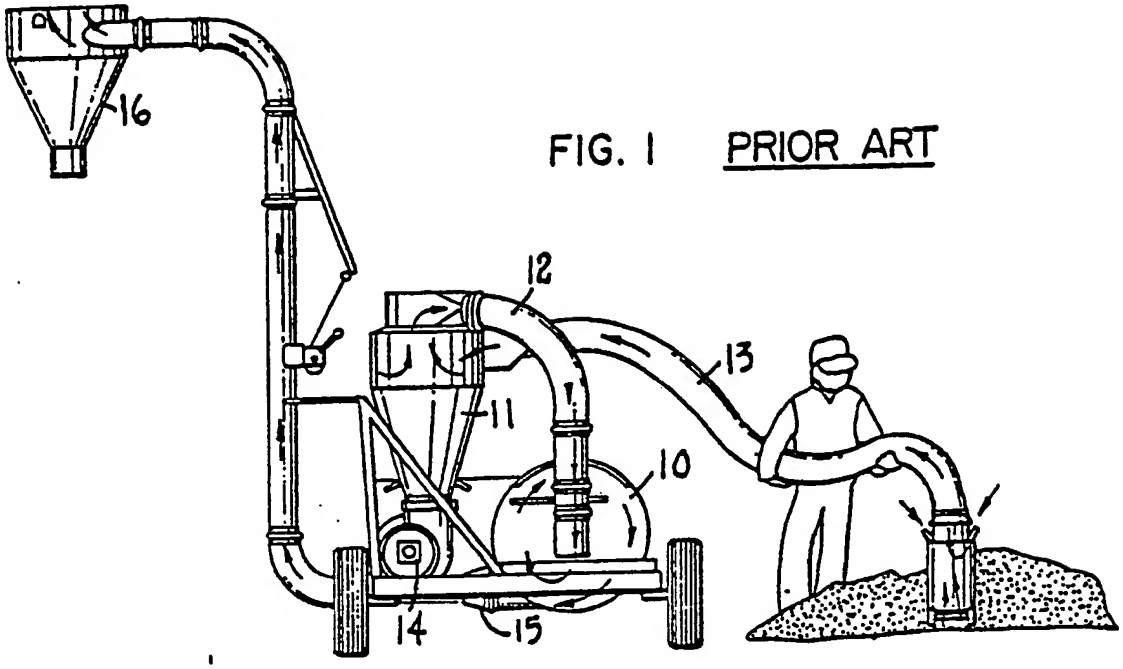


FIG. 1 PRIOR ART

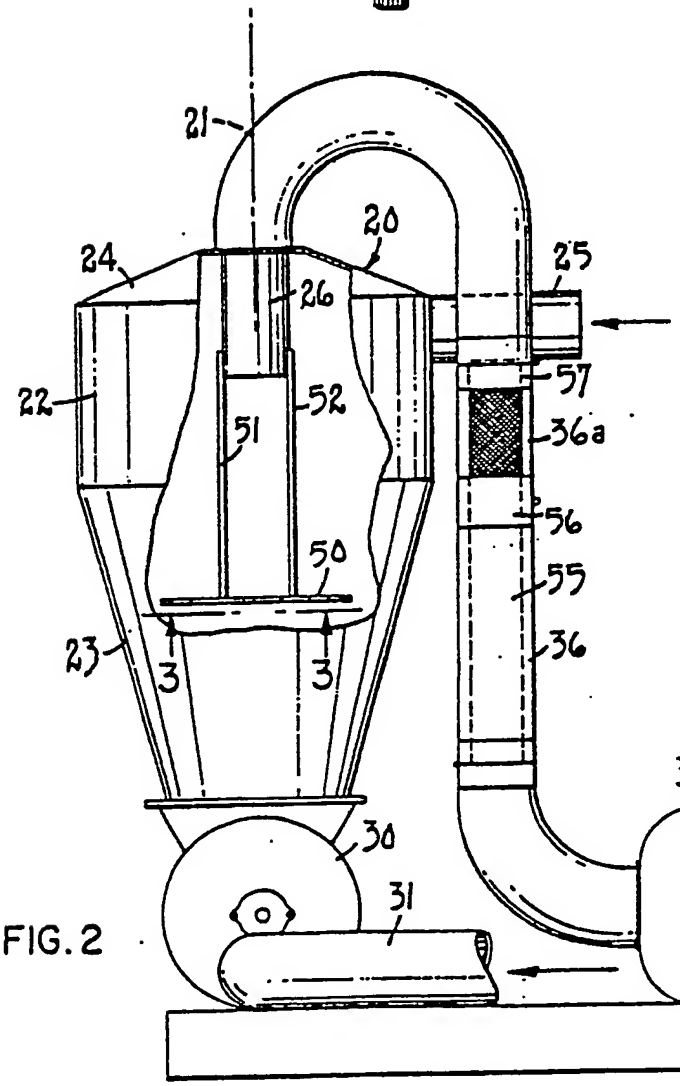


FIG. 2

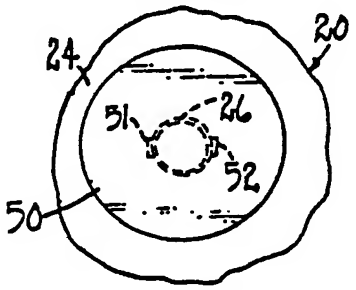
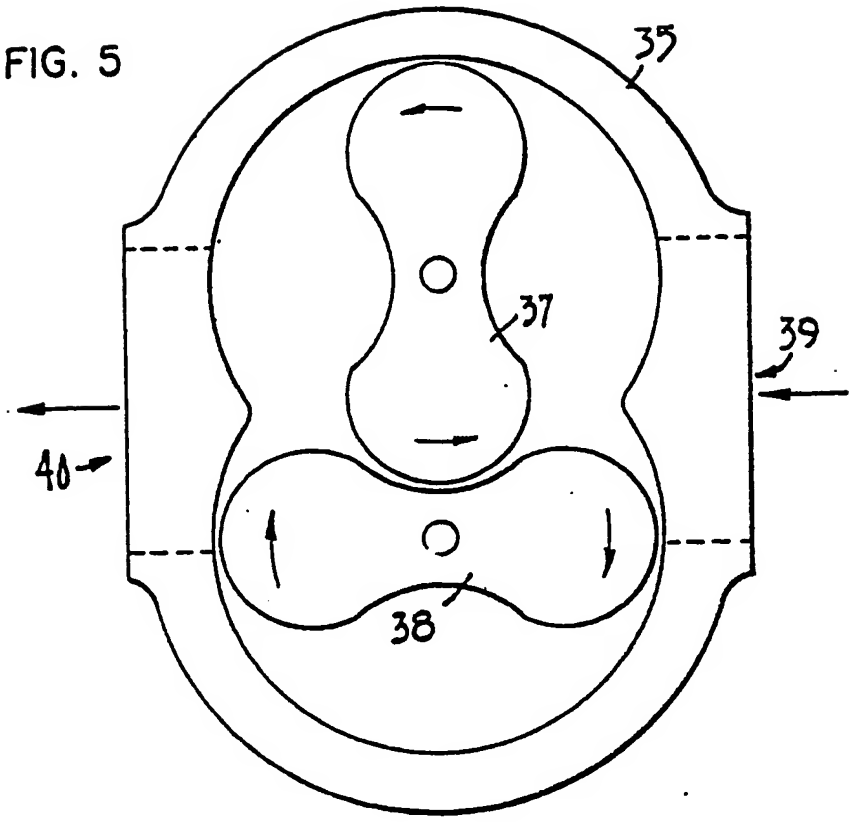


FIG. 3

FIG. 5



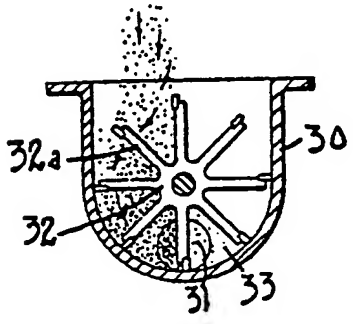


FIG. 4

INTERNATIONAL SEARCH REPORT

International Application No PCT/US 81/01006

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl.[3] B65G 53/28; B65G 53/60; B04C 5/181
U.S. Cl. 406/109; 406/173; 55/426

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
US	406/62, 67, 109, 163, 168, 169, 171, 173 55/426

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [6]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
X	US, A, 3,684,093, Published 15 August 1972, Kono, et al.	13-23
X	US, A, 1,031,862, Published 09 July 1912, Morse.	13,17-23
A	US, A, 4,149,861, Published 17 April 1979, Sogo, et al (Note col. 4, lines 39-49)	1-23
A	US, A, 3,077,365, Published 12 February 1963, Fisher.	7-8,13,21-22
A	US, A, 2,946,626, Published 26 July 1960, Atkinson, et al.	2,7-8,17,21
A	US, A, 2,230,425, Published 04 February 1941, Finnegan.	2,7-8,17,21
A	US, A, 1,811,597, Published 23 June 1931, Steinbart.	1-23
A	US, A, 1,723,703, Published 06 August 1929, Monaghan.	12-23
A	GB, A, 007,552, Published 05 September 1910, Parkinson.	1-23
	US, A, 2,849,079, Published 26 August 1958, Evans.	

* Special categories of cited documents: [15]

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"X" document of particular relevance

IV. CERTIFICATION

Date of the Actual Completion of the International Search [2]	Date of Mailing of this International Search Report [3]
21 August 1981	03 SEP 1981
International Searching Authority [1]	**Signature of Authorized Officer [20]**
ISA/US	Jeffery V. Nase

Form PCT/ISA/210 (second sheet) (October 1977)